The Relationship Between Instrumental Music Participation And Standardized Assessment Achievement Of Middle School Students[1]

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Abstract

This study attempted to investigate and better clarify the relationship between instrumental music participation and academic achievement through the use of multiple regression analysis. The research question posed was: What is the nature and strength of the relationship between instrumental music participation and a student's academic performance, when controls for gender, SES and I.Q. are introduced?

Analyses suggested that instrumental music participation related significantly to explaining the variance in language arts scores when controls were entered for I.Q. SES and gender. I.Q. was determined to be the strongest contributor to all standardized scores. Further analyses suggested that instrumental music participation contributed significantly to the variance for both math and language arts scores when controlling for gender and SES. SES was found to have a significant impact on all test scores, whereas gender (male) only contributed significantly to one set of standardized math scores. Results from this study appear to suggest that instrumental music participation does have a positive relationship to a student's academic performance with the strongest association occurring in reading and/or language arts.

Using a statistical design that allowed for controlling the variables Gender, I.Q., and Socio-Economic Status, which had been ignored in part or accounted for differently in previous studies on the relationship between instrumental music participation and academic success (Anello 1972; Trent, 1996; Zanutto, 1997); this study attempted to explore and assess the relationship of the variables in question on scholastic attainment to provide a clearer picture as to the nature and strength of the relationship participation in an instrumental music instruction program has on academic achievement. The research question posed was: What is the nature and strength of the relationship between instrumental music participation and a student's academic performance, when controlling for socio-economic status (SES), gender (GEN) and intelligent quotient (I.Q.), as measured by standardized assessment scores?

In an effort to promote and measure accountability and student performance through state mandated standardized testing, a "back to the basics" movement has been championed by a majority of USA educational policy makers and state legislators (Miller & Coen, 1994, p. 459). There has been an increasing, yet still

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limited, number of music educators and concerned policy makers in the past 25 years who have begun to look at empirical research that examines the relationship between instrumental music instruction and academic achievement in an effort to neutralize a policy rationale that fails to maintain and/or promote the role of instrumental music education in the curriculum.

Research into understanding higher brain functioning, using music as a "window," has revealed a possible relationship between the region of the brain that is stimulated by music and music instruction as the same area of the brain that controls spatial reasoning, which has been found to be directly connected to both mathematics and science ability (Graziano, Peterson & Shaw, 1999; Leng & Shaw, 1991; Rauscher & Zupan, 2000). Continued research efforts in this area could provide valuable data to support the significance and importance of publicly funded music instruction in the schools.

The intuitive conjecture that music and academic achievement have some type of relationship has been speculated by others, specifically Phillips (1976) and Grandin and Peterson (1998). It would seem that this supposition has been driven by the desire to determine if the existence of a positive relationship can be established between music and other content area subjects. If so, then a policy rationale that includes instrumental music instruction as a core academic subject might be argued and supported.

Wilson (1985) believes that policy makers in the United States should be concerned with the survival of music because of the deplorable state of public educational policy affecting music due to finances. At times, when financial resources are limited, programs are asked to prove their worth. Wilson states, "Music belongs in the curriculum as an important adjunct to verbal and computational skills" (p.41).

The National Center for Educational Statistics followed the progress of eighteen thousand students from the eighth grade to the tenth grade and showed that students who are involved in music receive grades between 6 – 10% higher than those students who are not involved in music. The College Boards association reports that students involved in musical performance ensembles outscore their classmates on the SAT; 49 points on the verbal section, and 36 points on the math section (Berlin, 1995).

Some studies suggest that there is a positive correlation between instrumental music instruction and academic achievement (Berlin, 1995; Cheek & Smith, 1998; Dreyden, 1992; Hill, 1987; Robitaille & O'Neal, 1981; Trent, 1996), while others seem to contradict these findings by suggesting that there is no significant relationship or that the relationship is minimal (Anello, 1972; Costa-Giomi, 1999). Still, others suggest that it may be that those students who achieve academically are naturally drawn to participate in instrumental music programs (Gordon, 1979; Hedden, 1982; Hill, 1987; Holmes, 1997; Phillips, 1976; Trent, 1996). The question as to the general nature of the relationship between instrumental music and academic achievement remains generally unresolved. The evidence supporting a strong correlation between these two variables is seemingly unquestionable, however, clarifying the nature of this relationship demands a continued examination by researchers in order to determine if the relationship might possibly be causal, as some research has implied and attempted to accomplish (Leng & Shaw, 1991; Rauscher, 1995; Rauscher et al, 1994; Rauscher & Zupan, 2000). Yet, sustained research has the potential to strengthen the role of instrumental music instruction in

the public schools as an important curricular component (Grandin & Peterson, 1998; Snyder, 1995).

By incorporating the use of ANOVAs and ANCOVAs to analyze the data, Anello (1972) noted a significant difference at the .01 levels in math, English and social studies Grade Point Averages (GPAs) between 163 instrumental and 163 non-instrumental music students. However, when intelligence was controlled through an analysis of covariance (ANCOVA) there were no significant differences found. Anello concluded that the differences in academic achievement between instrumental music students and non-instrumental music students could be attributable to the intelligence factor of the instrumental group.

Daryl Trent (1996) used two instruments to collect student data for analyses: the Texas Assessment of Academic Skills (TAAS) and the Texas Educational Assessment of Minimal Skills (TEAMS). Using a one-way analysis of variance, (ANOVA), he noted that there were significant differences in TEAMS math scores of high school senior music students, senior students involved in non-music activities and seniors not involved in school related extra-curricular activities, and TEAMS language arts scores with the same subjects. He found no significant differences in TAAS math and reading scores with the same subjects. Results of the ANOVA displayed a significant difference in math and language arts scores on the TEAMS between subjects. However, the data on the TAAS showed no significant difference. Trent explained the lack of significance with the TAAS scores as the result of a small sample size. These findings seem to suggest partial support to the hypothesis that enrollment in instrumental music instruction has a positive effect on other academic areas. Trent theorized that there might be a relationship between the music students' drive for excellence in musical performance and their drive for excellence in all academic areas.

By trying to determine what long-term relationships may exist between academic achievement and participation in an instrumental music program, Daniel Zanutto (1997) examined the effect of a five-year enrollment in instrumental music courses on academic achievement by comparing mean grade point averages between students enrolled in instrumental music and students not enrolled in instrumental music. His study attempted to explore the relationship between instrumental music participation and academic performance and the possibility that instrumental music instruction attracts academically motivated students.

Student performance was measured at yearly intervals beginning with grade 7 through grade 11. Using t-tests, Zanutto discovered consistently higher GPAs for instrumental music students in math, English, science and social studies, with significant gains specifically in math and science. Instrumental music students showed a slight advantage in English GPAs that increased in grade 8 through 10 over non-instrumental music students. Instrumental music students' social science GPAs also showed an advantage over non-instrumental music students.

Zanutto's research (1997) showed higher mean test scores in CTBS reading, language and math for instrumental music students. Instrumental music students also had better attendance than the non-instrumental music students. Based on his findings, Zanutto suggested that instrumental music had a positive effect on a student's academic achievement.

Cheek and Smith (1998) compared math scores (n = 113) from the Iowa Test of Basic Skills (ITBS) between students who received private music lessons and those who did not to determine if children who exercise their cortical neurons through

music were strengthening their neural circuits used for math, along with improving their spatial reasoning skills. Thirty-six private music students ITBS math scores were compared to 77 students who did not receive private lessons and no significant difference in the two sets of scores was found. However, 20 of the 36 private lesson music students who studied for two or more years scored significantly better then the 77 who did not ($t = 5.72$, $p < .001$). This study supported the assumption that music training enhances math achievement, provided that the training is for an extended period of time and provided that the lessons are individual private lessons.

Conversely, Eugenia Costa-Giomi's (1999) study involving students in grades four through six on the relationship between music instruction, specifically piano instruction, and enhanced cognitive abilities found that the students who received piano instruction obtained higher scores on the Developing Cognitive Abilities Test after one and two years of instruction than students who did not receive piano instruction. However, after three years of instruction, there was no significant difference found between the groups. Costa-Giomi hypothesized that it was possible that a decrease in the piano students' interest, enthusiasm and motivation for pursuing their musical instruction in the third year could account for this finding.

Graziano, Peterson and Shaw (1999) looked at early music training and enhanced spatial-temporal reasoning and determined that preschool students who received six months of piano instruction showed dramatic improvement in their spatial-temporal reasoning ability as opposed to students who did not receive musical instruction. They predicted that this enhanced spatial-reasoning ability as a result of the piano instruction could then be the cause of enhanced learning in proportional math. Using a Spatial-Temporal Math Video game software package, which was designed to teach proportional math, combined with piano instruction, the researchers found that these students scored significantly higher in proportional math and fractions than children given control training with the software package than those without.

Based upon the research of Anello (1972), Costa-Giomi (1999), Trent (1996), and Zanutto (1997) that explored the relationship between instrumental music instruction and academic achievement, the implications of the Rauscher & Zupan (2000) findings and the research of Graziano, Peterson & Shaw (1999) combined with the neurological theory of Leng & Shaw (1991), the purpose of this study was to build upon the knowledge base in an attempt to better clarify the relationship between instrumental music instruction and academic achievement by determining the strength of this relationship through the use of a series of multiple regression analysis models. Nelson and Zaichkowsky (1979) proposed the use of multiple regression analysis instead of ANOVA in the statistical treatment of educational research because it is capable of handling data that an ANOVA has traditionally found difficult to handle, namely, categorical and continuous data.

Methodology

The students for this research design were selected from two New Jersey middle schools located in what would be characterized as an urban/suburban middle class community of approximately fifty thousand residents. In 1998-1999 the school district serviced 8100 students in grades K-12 with an annual operating budget of approximately sixty-two million dollars.

The sample of students for this study was selected from each middle school's eighth grade student body enrolled during the 1998-1999 academic year,

approximately 620 students. The students were divided into two groups, 1) students enrolled in the instrumental music program for the 1998-1999 academic year, and 2) students not enrolled in the instrumental music program for the 1998-1999 academic year. The academic year 1998-1999 was selected because this was the last year the participating school district used two standardized assessments to test the eighth grade student population. Beginning with the 1999-2000 school year the district relied on the state standardized test as the sole academic assessment/diagnostic tool.

Students identified by district coding as Special Education students (children with substantiated learning disabilities) were removed from the total pool before the samples of students were selected. This particular exclusion was deemed necessary since standardized test score data for a percentage of these students were either incomplete and/or invalid. Students with learning disabilities who participate in the standardized testing are allowed modifications that regular education students are denied (i.e., a professional reader, extended time, etc.), which then brings into question the accuracy of these particular students' standardized scores. There was a total of 72 special education students removed from the total pool of 620 leaving a remaining population of 548 students.

Instrumental music students were identified anonymously by class lists drawn from the school district database by each school's guidance counselor. There were a total of 93 students enrolled in instrumental music for the 1998-1999 academic school year, 40 students at Middle School Number 1 (M.S. #1) and 53 at Middle School Number 2 (M.S. #2). The breakdown by school and gender for the instrumental music students in M.S. #1 was 14 males and 26 females and for M.S. #2 was 21 males and 32 females.

An equal percentage of students identified as never participating in an instrumental music program was drawn from each school to facilitate a proportionate balance of subjects between the two middle schools. Student identification and sorting was done solely by the use of district assigned student identification numbers. During the process of collecting and sorting data, it was discovered that eight of the students who had been randomly selected to the non-participating instrumental music group had actually been enrolled in instrumental music during a previous school year. These students were removed from the control group. The breakdown for the remaining data pool was 93 instrumental students (35 males and 58 females) and 85 non-instrumental music students (32 males and 53 females). The total data pool consisted of 178 students.

Student scores were collected from the California Achievement Test (CAT) which is given each year to students in grades six, seven and eight for diagnostic purposes. The Normal Curve Equivalent (NCE) scores were collected for each student in mathematics, reading and language arts sections of the CAT assessment. The CAT is a norm-referenced assessment in which student performance is measured against one another to determine the student's relative standing in relation to that particular population of students (Sprinthall, 1997).

Achievement scores were also obtained from the Grade Eight Proficiency Assessment (GEPA), which is administered in March of each academic year by the State of New Jersey. Total scores were collected for each student on the two main batteries of the GEPA in both Mathematic and Language Arts. The GEPA does not include reading as a separate battery but includes it as one of seven sub-batteries in the Language Arts total score.

The GEPA is a standard based assessment or criterion-referenced test in which student performance is based on pre-determined standards. This assessment determines a student's absolute performance concerning mastery of the material being assessed (Sprinthall, 1997).

I.Q.s for each student were obtained from the Cognitive Abilities Test (Cog AT), which is administered by the school district to all students in fifth and ninth grade. For the purpose of this study, scores were obtained from the fifth grade CogAT Standard Age Score for each student in the data pool.

The following demographic information germane to this research design was also obtained from the school district's student database: participation status in instrumental music (determined by class lists from each school for band and orchestra), gender, and student SES (determined by free and reduced lunch student lists provided be each schools' guidance counselor respectively). All statistical analyses were done through the use of the statistical software package SPSS 8.0.

The dependent variables for the regression analyses were the CAT-NCE reading and mathematics scores and the GEPA language arts and mathematics total scores. In order to facilitate multiple regression analyses of the data, a system of dummy coding was employed. The independent variables were blocked to better clarify instrumental music participation's relationship with academic achievement, the independent variable entrance selection for the regression models was based primarily on determining if this variable (IMUSIC) retained its relative strength when controls for the other variables were entered into the regression equation. The basis of this reasoning originated from previous research that suggested that SES, I.Q. and gender might influence student performance on standardized assessments (Anello, 1972; Cole, 1997; Dreyden, 1992; Haertel & Walberg, 1980; Kruse 1996; Phillips 1976; Webb, 1984).

Results

Each regression analysis incorporated a separate/block entry format for each of the independent variables in order to determine the significance of each variable after it was entered into the regression and to more accurately determine the strength of the relationship between each predictor variable and the specific dependent measure. The order that each variable was entered into the regression was Model 1: IMUSIC, Model 2: IMUSIC & GEN, Model 3: IMUSIC, GEN & SES, Model 4: IMUSC, GEN, SES and I.Q.

When the CAT-NCE reading score (n = 132) was the dependent variable, the combined effect for all of the variables, Model 4, explained 45.9% (R^2 = .459, p = .000) of the variance, which was found to be significant (see Table 1). IMUSIC was found to be a significant contributor in Models 1, 2 and 3 but not in 4 when I.Q. was entered. SES, when entered in Model 3, was also found to be significant but not so in Model 4, and gender (GEN) had no significant impact throughout all models. I.Q. was found to have had the largest impact (b = .632) with an R^2 change value of .326, indicating an enormous impact on the overall explained variance (32.6%) for the dependent measure.

Significant to note here is that while I.Q. was determined to be the strongest predictor variable overall, both the beta for IMUSIC and SES (specifically, students who participate in an instrumental music program and students not on a free and reduced lunch program) indicated a significant contribution to the explained variance of the dependent measure until the entrance of I.Q. Relevant to this particular study is the fact that IMUSIC contributed significantly to the overall

variance of the CAT-NCE reading scores when controlling for SES and gender (GEN).

Based upon this data, additional analyses determined the existence of significant, although weak, correlations between IQ and the other independent variables (w/gender: $r = -.190$, $p < .05$; w/socioeconomic status: $r = -.298$, $p < .01$; instrumental music status: $r = .306$, $p < .01$). Based on the correlations between I.Q. SES, gender and most importantly Instrumental Music (Phillips, 1976; and Webb, 1984), and the implication that these correlations may directly effect the regression model's coefficient of determination (R^2) (Hinkle, Wiersma, & Jurs, 1998); the impact of the other predictor variables when included with I.Q. in the regression has to be surmised by analyzing the particular beta value for each predictor variable in the Model 4 regression. Although these correlations were significant, none were strong enough to suggest colinearity between IQ and any of the other independent variables (Tacq, 1997).

Table 1

Multiple Regression For The CAT-NCE Reading Achievement Scores

Model	Variables	Beta	R	R^2	R^2 Change	Sig.
1	IMUSIC	.234	.234	.055	.055	.007
2	IMUSIC	.233				.007
	GEN	-.072	.245	.060	.005	.397
3	IMUSIC	.169				.047
	GEN	-.069				.401
	SES	-.278	.365	.133	.073	.001
4	IMUSIC	.016				.817
	GEN	.053				.430
	SES	-.125				.072
	IQ	.632	.678	.459	.326	.000

Mult. R	R^2	Adj. R^2	Std. Error
.678	.459	.442	12.10

When the GEPA language arts total score (n = 131) was the dependent variable, the combined effect for all of the variables, Model 4, explained 41.8% ($R^2 = .418$, $p = .000$) of the variance, which was found to be significant (see Table 2). IMUSIC (students who participate in an instrumental music program) was found to be a significant contributor in Models 1, 2, 3 and 4 even after I.Q. was entered. SES (students not on a free and reduced lunch program) was also found to be significant for both Model 3 and 4, and gender (GEN) had no significant impact through Models 2 and 3 but was found to be significant in Model 4, implying a relationship between females and academic accomplishment in language arts. It can only be assumed that significant correlations exist between gender (GEN) and the other predictable variables in Models 2 and 3, which influenced its impact on this particular dependent variable until the inclusion of I.Q. I.Q. was found to have had the largest impact ($b = .466$) with an R^2 change value of .180, indicating the strongest impact on the overall explained variance (18 %) for the dependent measure.

A noteworthy finding with the GEPA language arts total scores is that while I.Q. was determined to be the strongest predictor variable overall, the betas for IMUSIC, SES and gender (GEN) contributed significantly to the explained variance of the dependent measure even after the inclusion of I.Q. Relevant to this particular study is the fact that IMUSIC contributed significantly to the overall variance of the GEPA language arts total scores when controlling for SES, gender (GEN) and I.Q.

Table 2

Multiple Regression For The GEPA Language Arts Total Scores

Model	Variables	Beta	R	R^2	R^2 Change	Sig.
1	IMUSIC	.359	.359	.129	.129	.000
2	IMUSIC	.358				.000
	GEN	.096	.371	.138	.009	.244
3	IMUSIC	.276				.001
	GEN	.096				.218
	SES	-.327	.488	.238	.100	.000
4	IMUSIC	.156				.033
	GEN	.176				.012
	SES	-.288				.002
	IQ	.466	.647	.418	.180	.000

Mult. R	R^2	Adj. R^2	Std. Error
.647	.418	.400	13.50

When the CAT-NCE mathematics score (n = 126) was the dependent variable, the combined effect for all of the variables, Model 4, explained 59.6% (R^2 = .596, p = .000) of the variance, which was found to be significant (see Table 3). IMUSIC (students who participate in an instrumental music program) was found to be a significant contributor in Models 1 and 2 but not in Models 3 and 4. SES (students not on a free and reduced lunch program) was found to be significant for both Models 3 and 4, and gender (GEN) was significant in Models 2 and 3 but not in 4. A noteworthy consideration is that the beta value for gender (GEN) indicates that male students scored higher on the dependent measure than did female students. I.Q. was found to have had the largest impact (b = .657) with an R^2 change value of .357, indicating another strong impact on the overall explained variance (35.7%) for the dependent measure.

Curiously, both the beta for IMUSIC and gender (GEN) indicated a significant contribution to the explained variance of the dependent measure until the entrance of SES, although gender (GEN) still remained a contributor until the addition of I.Q. The inclusion of SES with I.Q. negated the influence of both IMUSIC and gender (GEN), implying IMUSIC's weak impact upon the dependent measure. IMUSIC contributed significantly to the overall variance of the CAT-NCE mathematics scores when controlling for gender (GEN), however, when both SES and I.Q. were added that impact was negated, possibly due to significant correlations between the variables or possibly due to a weak relationship between IMUSIC and the CAT-NCE mathematics scores.

These finding seem to suggest that instrumental music participation (IMUSIC) might not have as strong a relationship to a student's mathematics achievement as had been previously thought (Berlin, 1995; Cheek & Smith, 1996, Zanutto, 1997) or that gender (GEN) seems to play a larger role than had been

anticipated. The overall data pool for this study was predominantly female (almost 2:1). There was an elevated association between instrumental music participation and gender for both of these middle schools (favoring females). These results seem to imply that males do better on the CAT math assessment and if that were the case, then IMUSIC's impact would logically be marginal.

Table 3

Multiple Regression For The CAT-NCE Mathematics Achievement Scores

Model	Variables	Beta	R	R^2	R^2 Change	Sig.
1	IMUSIC	.227	.227	.052	.052	.010
2	IMUSIC	.227				.008
	GEN	-.233	.326	.106	.054	.007
3	IMUSIC	.134				.101
	GEN	-.223				.005
	SES	-.377	.489	.239	.133	.000
4	IMUSIC	-.040				.519
	GEN	-.090				.129
	SES	-.254				.000
	IQ	.657	.772	.596	.357	.000

Mult. R	R^2	Adj. R^2	Std. Error
.772	.596	.583	10.26

When the GEPA mathematics total score (n = 130) was the dependent variable, the combined effect for all of the variables, Model 4, explained 69.2% (R^2 = .692, p = .000) of the variance, which was found to be significant (see Table 4). IMUSIC (students who participate in an instrumental music program) was found to be a significant contributor in Models 1, 2, and 3 but not 4, after I.Q. was entered. SES (students not on a free and reduced lunch program) was found to be significant for both Model 3 and 4, and gender (GEN) had no significant impact through Models 2, 3 and 4. I.Q. was found to be the largest contributor (b = .784) with an R^2 change value of .514, indicating the strongest impact on the overall explained variance (51.4 %) for the dependent measure.

A noteworthy finding with the GEPA mathematics total scores is that while I.Q. was determined to be the strongest predictor variable overall, the beta for IMUSIC (students who participate in an instrumental music program) still contributed significantly to the overall variance of the GEPA mathematics total scores when controlling for SES and gender (GEN).

The regression models for both reading and mathematics achievement scores clearly indicate that the independent variable I.Q. demonstrated the strongest contribution to the overall variance, favoring students with above average I.Q.s. When I.Q. is entered in Model 4, the regressions indicated that participation in an instrumental music program had no significant contribution to explaining the overall variance in scores on an eighth grade student's reading and mathematics achievement unless the GEPA language arts score was the sole dependent measure.

Table 4

Multiple Regression Output For The GEPA Mathematics Total Scores

Model	Variables	Beta	R	R^2	R^2 Change	Sig.
1	IMUSIC	.257	.257	.066	.066	.003
2	IMUSIC	.259				.003
	GEN	-.153	.299	.090	.023	.072
3	IMUSIC	.180				.033
	GEN	-.152				.061
	SES	-.307	.422	.178	.088	.000
4	IMUSIC	-.012				.823
	GEN	-.023				.654
	SES	-.132				.013
	IQ	.784	.832	.692	.514	.000

Mult. R	R^2	Adj. R^2	Std. Error
.832	.692	.682	15.86

When controlling for SES and gender (GEN), the regressions indicate a strong relationship between students who participate in instrumental music instruction and reading achievement when the CAT and GEPA reading/language arts scores are the dependent variables and mathematics achievement when the GEPA math score is the dependent variable. The exclusion of I.Q. from models 1 through 3 indicates that when included in the fourth regression model, its overall effect diminishes the impact of the other variables in that model.

Conclusions and Discussion

In order to determine and clarify the strength of the relationship between students who participate in an instrumental music instruction program and academic achievement, as measured by standardized assessments, a series of multiple regression analyses were employed. The rationale for employing this statistical procedure was borne from the findings of Anello (1972), Trent (1996) and Zanutto (1997) and the statistical suggestion of Nelson and Zaichkowsky (1979).

The results suggest that participation in an Instrumental Music program had a significant relationship to academic achievement on the GEPA language arts scores when controls were entered for I.Q. SES and gender (GEN). However, I.Q. was determined to be the strongest contributor overall for the remaining dependent variables, congruent with earlier findings of similar research (Anello, 1972; Corral, 1998; Dreyden, 1992; Friedman, 1959; Goeghegan & Mitchlemore, 1996; Hill, 1987; Holmes, 1997; Trent, 1996; Zanutto, 1997). Because of the overall strength of I.Q., analyses revealed significant correlations with all of the independent variables, the strongest being instrumental music participation ($r = .306$; $p < .01$), which suggested an interaction between the variables that might impact the regression model (Hinkle, Wiersma & Jurs, 1998).

The separate/block entry model analysis determined a significant association between participation in an Instrumental Music program and student achievement on the CAT reading scores and the GEPA math and language arts scores when controls were entered for SES and gender (GEN). However, on the CAT math scores, once SES was introduced in Model 3, Instrumental Music participation did not significantly contribute to the variance, whereas gender (GEN) did; this was the only time gender (GEN), specifically males, made a significant contribution to a

Model 3 regression. The possible connection to IMUSIC's contribution is the fact that the ratio of females who participated in instrumental music outnumbered the males by almost 2:1. SES was found to contribute significantly to the variance on all test scores in both Models 3 and 4 except when the CAT reading score was the dependent variable.

Since the results of this study vary, the data suggests that the strongest relationship occurred between students who participate in an instrumental music program and reading and/or language arts achievement, based on the regression outputs for both the CAT and GEPA achievement scores. Although instrumental music participation seems to be associated with mathematics achievement, the relationship was inconsistent based on the variables being controlled and the dependent variable being tested. This inconsistency brings into question results from previous research findings that suggest instrumental music students achieve at a higher level in math than their counterparts (Berlin, 1995; Cheek & Smith, 1996; Zanutto, 1997).

The true independent effect and impact participation in instrumental music has upon a student's academic achievement may be overshadowed by the significant overall impact of I.Q. The simple correlation between I.Q. and students enrolled in instrumental music support the supposition that students who participate in a formal instrumental music program are more likely to have an above average I.Q. than students who do not participate in a formal instrumental music program. Since most standardized assessment tools that test a student's reading and mathematics achievement tend to give an advantage to students with an above average I. Q. (Haertel & Walberg, 1980) it stands to reason that instrumental music students will score higher than non-instrumental music students. Consequently, the relationship between I.Q. and instrumental music participation cannot be ignored and needs to be explored more fully.

One variable not accounted for in the design of this study was the possible inconsistency in the level of music instruction between the two middle schools in which the instrumental music student population was drawn. Since Middle School #1 contributed 40 students and Middle School #2 contributed 53 students, the possibility exists that the level of instruction might have had an effect on the overall results.

Since the purpose of this study was to build upon the previous research of Leng and Shaw (1991), Miller and Coen (1994) and Rauscher and Zupan (2000) who all attempted to explore the relationship between instrumental music and a student's cognitive development, the findings reported here suggest that continued research in this area has validity. The results of this study imply that participation in an instrumental music program might have a positive relationship with a student's academic achievement. As to the true nature of this association between instrumental music participation and academic achievement, further study seems warranted and supported.

The main motivating factor underlying the purpose of this research project was to provide a clearer picture into the nature and strength of the relationship between participation in an instrumental music education program and student achievement on standardized assessments. The data analyses reported here assists in supporting the opinion of Kelstrom (1998), that during the present educational climate in the USA, one that champions a myopic view of a "back to the basics" mentality, an argument for instrumental music inclusion based on the strength of its

positive relationship to student academic achievement appears warranted and necessary if these programs are going to be supported now and in the future.

Policy makers who continue to criticize the USA curriculum for its lack of rigor and ability to prepare the current crop of students to compete in a global economy, and do so based almost entirely on the results of standardized assessments, need to be advised that a positive relationship between students who participate in public school instrumental music programs and academic achievement as measured by standardized testing, is implied. An inference that needs to be seriously considered whenever curricular policy is going to be changed that eliminates instrumental music instruction from the public school environment in order to focus on the more rigorous academic course work.

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References

Anello, J.A. (1972). A comparison of academic achievement between instrumental music students and non-music students in the El-Dorado and Valencia schools of the Placentia Unified school district. Doctor of Education, Brigham Young University, UT, USA. UMI Dissertation Services, AAT 7229562.

Berlin, B. (1995). Strike up the elementary school band. Principal, 75 (2), 35-37.

Cheek, J. & Smith, L.R. (1998). Music training and mathematics achievement of ninth graders. Research report. (ERIC Document Reproduction Service No. ED 425 918)

Cole, N.S. (1997). The ETS gender study: How females and males perform in educational settings. Princeton, NJ: Educational Testing Service. (ERIC Document Reproduction Service No. ED 424 337)

Costa-Giomi, E. (1999). The effects of three years of piano instruction on children's cognitive development. Journal for Research in Music Education, 47 (3), 198-212.

Corral, J.S. (1998). A comparison study of the California test of basic skills between fourth and fifth grade instrumental music pullout students and students not involved in the instrumental music program. Research Report. (ERIC Document Reproduction Service No. ED 430 013)

Dreyden, S. (1992). The impact of instrumental music instruction on the academic achievement of fifth grade students. Unpublished masters thesis, Fort Hays State University, TX, USA.

Friedman, B. (1959). An evaluation of the achievement in reading and arithmetic of pupils in elementary school instrumental music classes. Doctor of Education, New York University, NY, USA. UMI Dissertation Services, AAT 5906219.

Goeghegan, N. & Mitchelmore, M. (1996). Possible effects of early childhood music on mathematical achievement. New South Wales, Australia: Australian Research in Early Childhood Education, Volume 1, (ERIC Document Reproduction Service No. ED 406 036)

Gordon, M. (1979). Instrumental music instruction as a contingency for increased reading behavior. Journal of Research in Music Education, 27 (2), 87-102.

Grandin, T., Peterson, M. & Shaw, G. (1998). Spatial-temporal versus language-analytic reasoning: The role of music training. Arts Education Policy Review, 99 (6), 11 – 14.

Graziano, A., Peterson, M. & Shaw, G. (1999). Enhanced learning of proportional math through music training and spatial-temporal training. Neurological Research, 21 (3/99), 139-152.

Haertel, G.D. & Walberg, H.J. (1980). Ability and learning: A theoretical and empirical synthesis. Washington, DC: National Institute of Education. (ERIC Document Reproduction Service No. ED 206 047)

Hedden, S.K. (1982). Prediction of music achievement in the elementary school. Journal of Research in Music Education, 30 (1), 61-68.

Hill, W.L. (1987). A comparison of factors related to participation and achievement in instrumental music at the middle school level in the Denver public schools. Doctor of Philosophy, University of Colorado at Boulder, CO., USA. UMI Dissertation Services, AAT 8723464.

Hinkle, D., Wiersma, W. & Jurs, S.G. (1998). Applied statistics for the behavioral sciences (4th ed.). Boston, MA: Houghton Mifflin Company.

Holmes, D. (1997). An examination of fifth grade instrumental music programs and their relationship with music and academic achievement. Doctor of Philosophy, University of Washington, WA, USA. UMI Dissertation Services, AAT 9736294.

Kelstrom, J.M. (1998). The untapped power of music: Its role in the curriculum and its effect on academic achievement. NASSP Bulletin, 82 (597), 34-43.

Kruse, K. (1996). The effects of a low socioeconomic environment on a student's academic achievement. Research Report. (ERIC Document Reproduction Service No. ED 402 380)

Leng, X., & Shaw, G.L. (1991). Toward a neural theory of higher brain function using music as a window. Concepts in Neuroscience, 2 (2), 229-258.

Miller, A., & Coen D. (1994). The case for music in the schools. Phi Delta Kappan, 75 (6), 459-461.

Nelson, L.R., & Zaichkowsky, L.D. (1979). A case for using multiple regression instead of ANOVA in educational research. Journal of Experimental Education, 47 (4), 324-330.

Phillips, D. (1976). An investigation of the relationship between musicality and intelligence. Psychology of Music, 4 (2), 16-31.

Rauscher, F. (1995). Does music make you smarter? PTA Today, 20 (5), 8-9.

Rauscher, F. et al. (1994). Music and spatial task performance: A causal relationship. Paper presented at the Annual Meeting of the American Psychological Association, *102nd, Los Angeles, CA, August 12-16*. (ERIC Document Reproduction Service No. ED 390733)

Rauscher, F. & Zupan, M.A. (2000). Classroom keyboard instruction improves kindergarten children's spatial-temporal performance: A field experiment. Early Childhood Research Quarterly, 15 (2), 215 - 228.

Robitaille, J.P., & O'Neal, S. (1981). Why instrumental music in elementary schools? Phi Delta Kappan, 63 (3), 213.

Snyder, N. (1995). An interview with Frances Rauscher: Music and reasoning. Teaching Music, 2 (5), 40 – 50.

Sprinthall, R.C. (1997). Basic statistical analysis (5th ed.). Needham Heights, MA: Allyn and Bacon.

Tacq, J. (1997). Multivariate Analysis Techniques in Social Science Research. Thousand Oaks, CA; SAGE Publications Inc.

Trent, D. (1996). The impact of instrumental music education on academic achievement. Doctor of Education, East Texas State University, TX, USA. UMI Dissertation Services, AAT 9638444.

Webb, M.N. (1984). An investigation of the relationship of musical aptitude and intelligence of students at the third grade level. Doctor of Education, The University of North Carolina at Greensboro, NC, USA. UMI Dissertation Services, AAT 8509188.

Wilson, F.R. (1985). Music as a basic schooling for the brain. Music Educators Journal, 71 (9), 39-42.

Zanutto, D. R. (1997). The effect of instrumental music instruction on academic achievement. Doctor of Education, California State University, CA, USA. UMI Dissertation Services, AAT 9812100.

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